



Succeed Beyond Chassis

MicroTCA整机工程及国产化实践

MicroTCA Chassis System Engineering & Solutions

上海源中(YZITECH)
2021(V1)



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MicroTCA整机工程实践

MicroTCA System Engineering



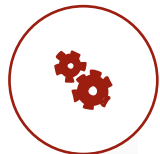
上海源中(YZITECH)

专业的机箱系统整机工程服务提供商-Professional chassis system engineering service provider

“一站式”的专业机箱系统整机工程解决方案专家-One Stop Solution to Chassis System Engineering

外形及结构部件 (Mechanical Parts)

Sheet Metal、Guide Rail
.....



电子部件 (Electronic Parts)

背板、电源、整机工程服务控制板等。
Backplane、PSU、Fan、Control Board...
.....



嵌入软件 FRU Firmware

整机工程服务控制软件、
FRU IPMI Protocol.
.....



单板结构件附件 Blade Accessories

面板、托盘、拉手条、Heatsink.
Front Panel、Handle、Heatsink for Blade
.....



整机工程组成

外观造型件	整机结构件	外观包装件	内外部线缆	电源模块	电源分配板	数据背板	风扇	温度传感器	系统管理板	管理软件	单板结构件	单板散热器
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基于MicroTCA标准架构系统平台的主要困难, YZI 做了哪些工作

What We have done and are doing on MicroTCA



硬件研发及集成 (Hardware Developing and Integration)

- 开发了带标准MicroTCA 管理标准的电源接口板, 通过此接口板与业界通用或加固标准的12V输出的电源结合, 实现MicroTCA系统电源的多样化选择及成本的降低
An intelligent power interface board with standard MicroTCA management standard is developed. The combination of this interface board and standard PSU, gives more diversified selection of MicroTCA system power supply to the MicroTCA system integrators. It also give the chance for MicroTCA system integrator to run the system w/o MCH
- 结构上的创新, 开发了自主知识产权的导轨
Structural innovation has been made, we have developed a new metal guide rail with independent intellectual property rights, Compared with the plastic guide rail, the new metal guide rail has better performance in strength and anti vibration.
- 集成的AMC CPU板 (Intel 或 ARM) 、存储板的资源
We have integrated also AMC board resources(AMC CPU Board and AMC Storage Board) in the industry,
- 提供成熟的MicroTCA加固机箱解决方案
Lots of work had been done on the MicroTCA ruggedized chassis system solutions, they are ready now.



软件研发及集成 (Software Developing and Integration)

- 实现电源及风扇的标准MicroTCA IPMI接口
We implement the standard MicroTCA IPMI protocol interface for intelligent power supply and fan tray
- 简化版的MCH管理协议接口
Simplified MCH Firmware is developing now



YZITECH Confidential



MicroTCA 整机工程---整机设计

整机工程设计

MicroTCA-标准整机设计 Chassis System Design

◆ 机箱结构

- MicroTCA.4 规范, 整机高度10U,前部12 AMC前卡槽位, 后部12 AMC RTM槽位两个独立的MCH槽位, 前面横向两个独立风扇框, 后面竖向两个独立电源模块
- 19" 10U Height, 12AMC Slots, 12 RTM Slots, 2 MCH Slots, 2 Hot-swap Fan Trays, 2 Hots-swap PSUs
- 自制专用导轨, YZI Guide-Rail

◆ 整机散热

- 整机700CFM, 前部槽位30CFM后部槽位10CFM
- 支持前部槽位100W散热
Total 700CFM, 30CFM Front Slot, 10CFM Rear Slot

◆ 背板

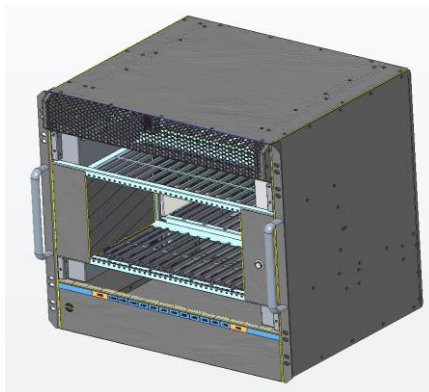
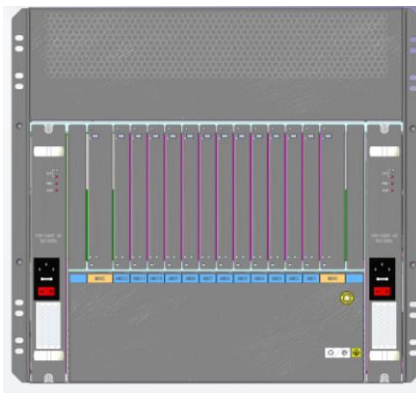
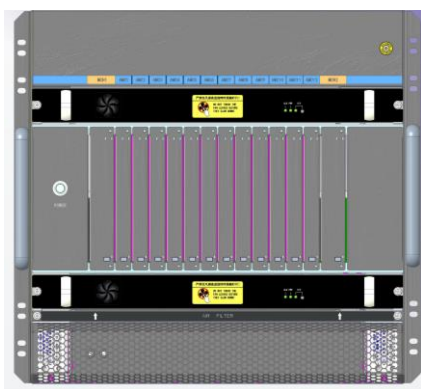
- 定制拓扑结构定制化背板, 差分速率3.125\10.3125Gbps
Customized Topology, Supporting 10.3125Gbps on Fat Pipe

◆ 二次电源

- 2个可插拔二次电源1+1热备工作方式
2 Hot Swap PSU, 1+1 Hot Redundant Work mode
- 模块功率1200W/1600W/2000W可选
1200W/1600W/2000W PSU
- 支持220VAC, -48VDC, 240VHDC电源输入
Supporting 220VAC, 48DC, 240VHDC Inlet

◆ 机箱管理

- 支持标准IPMI机箱管理,支持应用级定制化I2C/can机箱管理
Standard IPMI and Customized I2C/CAN control msg



优点(Advantages)

- 机箱拉高至10U, 提升散热能力, 每槽位>100w散热能力
- 内置式双风扇框抽拉式, Z型风道
- 带助拔器的防尘网结构, 助力快速更换。
- AMC 面板结构件的精密加工制造
- 智能二次电源模块设计, 功率可根据需求灵活配置



MicroTCA 整机工程---电源分配设计

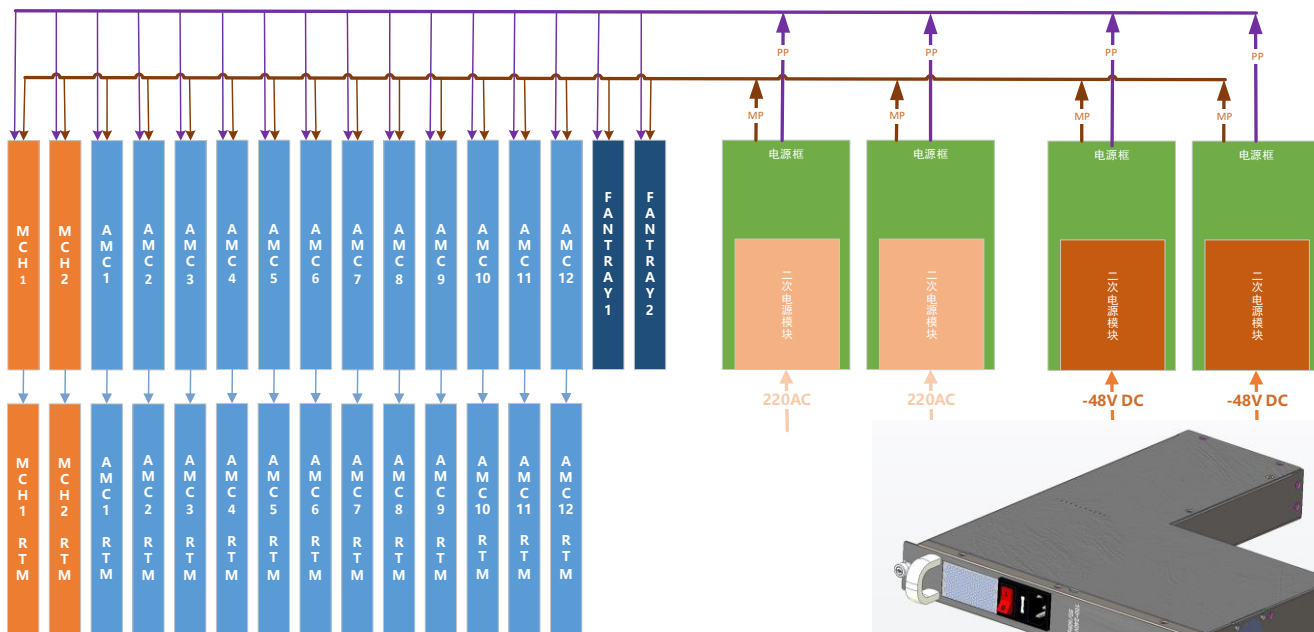
整机工程设计

MicroTCA-电源转换及分配设计 Power Design

- 符合MicroTCA管理标准的智能电源模块
MicroTCA PM IPMI Management Protocol
- 支持应用级定制化I2C机箱管理
Proprietary Customized PM Management Protocol
- 整机电源分配电路 (如右图所示)
MicroTCA MP,PP Distribution
- 2个可插拔二次电源1+1热备工作方式
PSU Hot Swap Redundancy
- 模块功率1200W/1600W/2000W可选
PM Power Selection 1200W/1600W/2000W
- 支持220VAC, -48VDC, 240VHDC电源输入
Multiple-Power-Inlet Selection, 220VAC, -48VDC, 240VHDC

传统电源缺点 (Current PSU Weakness)

- Lack of high-power of PM,
- Do not support MicroTCA IPMI and
- Slot Occupation,
- Expensive



新电源优点(Advantages)

- 标准二次电源模块、智能分配电路分离式创新性设计
Intelligent Standard PSU + Intelligent Power Distributed Board
- 二次电源模块功率可灵活选型配置
More Standard PSU Module can be selected
- 标准IPMI控制模式+自定义控制模式
Standard IPMI Work mode + Customized Work Mode
- 业界最全的电源输入接入模式
220V AC, -48DC, 240VHDC, 336VHDC are all supported by changing the different PSU.



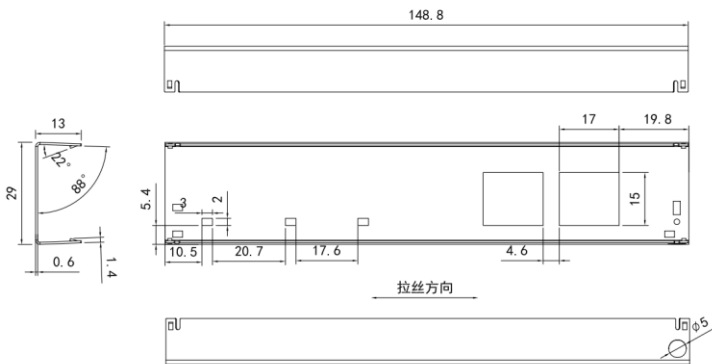
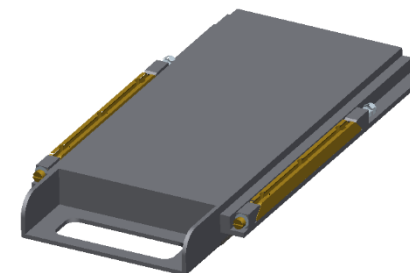
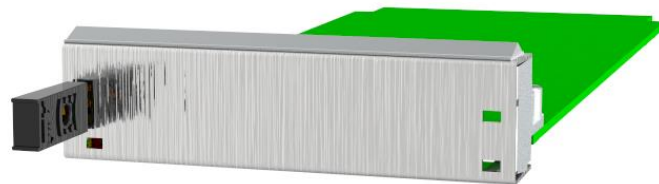
MicroTCA 整机工程---AMC结构件设计制造

整机工程设计

MicroTCA-AMC刀片结构件设计制造

◆ AMC 刀片结构件

- 提供AMC面板设计加工服务
- 提供AMC单板散热器设计加工服务



优点(Advantages)

- 传统工艺购买标准AMC面板，二次加工开孔受已折弯成型限制，开孔精度受限，部分开孔工艺受限
- 采用定制数冲模具，实现一体成型，快速实现小批量多品种。



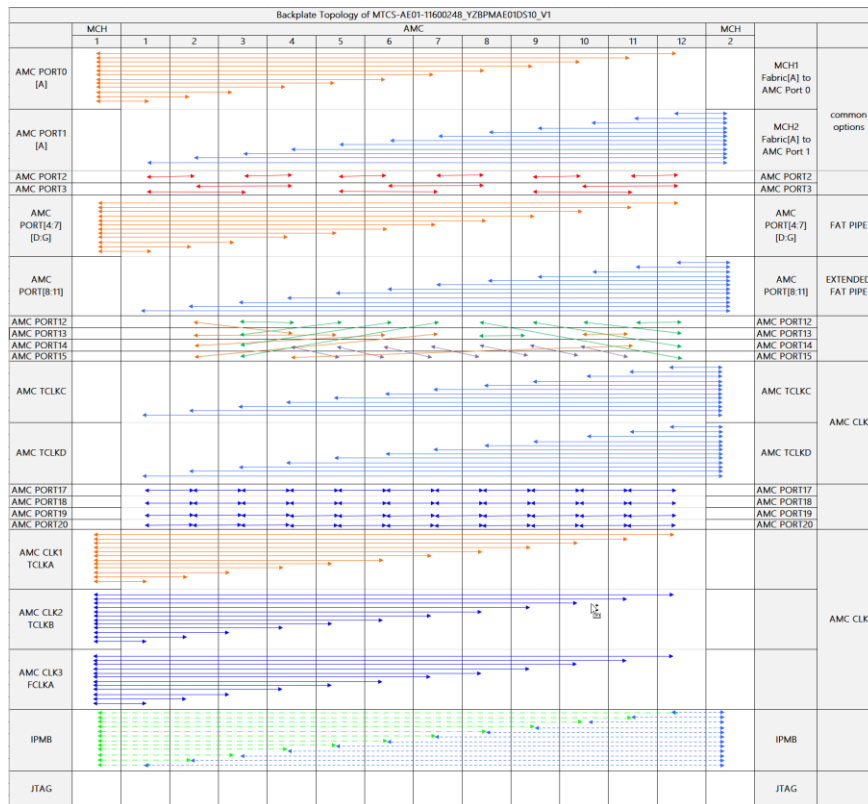
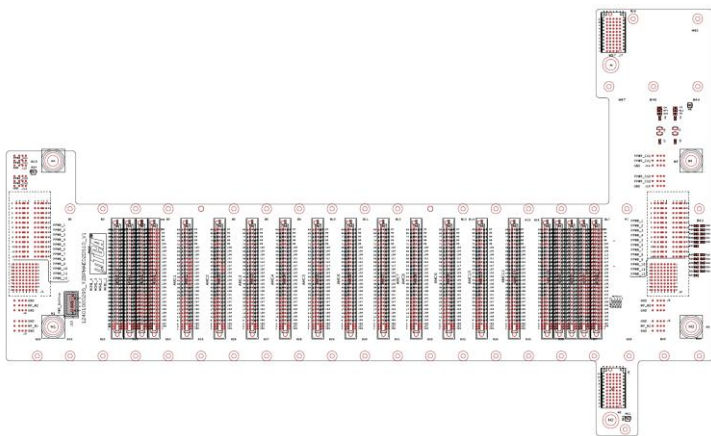
MicroTCA 整机工程---背板设计

背板设计

MicroTCA-背板设计

规格性能

- MicroTCA.4 Specification
- 12个 Single/double/midsize AMC RTM Slots
- 12 AMC RTM Slots
- 2 MCH Slots
- 2 Fan Trays Slots
- Port0 & Port1 : Gigabit lan switching
- Fat Pipe (Port4: 7 & Port 8:11) : Dual-Star PCIE3.0 or 10GKR or 40GKR4
- Port2 & Port3 : SAS or SATA Hard Disk Connection
- Port12 to Port15: AMC Customized-Direct- Connection
- Port17 to Port20 AMC Serial-Connect
- Clock: Clock1~3 From MCH1 Slot, ClockC~D From MCH2 Slot



优点(Advantages)

- 速率提升: 背板高速材料, 支持 10.3125Gbps差分速率 (High-Speed PCB Material, 10.3125Gbps)
- 背板拓扑: 可定制 (Supporting Backplane Topology Customization)
- 通道电流通流量提升: 增强 MCH 和 CU 的 MP 电源至 3A, AMC通道可提升通流量 (定制配置) MCH & CU MP up to 3A
- 通道电流通流量提升: 增强 CU 的 PP 电源至 30A (CU PP up to 30 A)



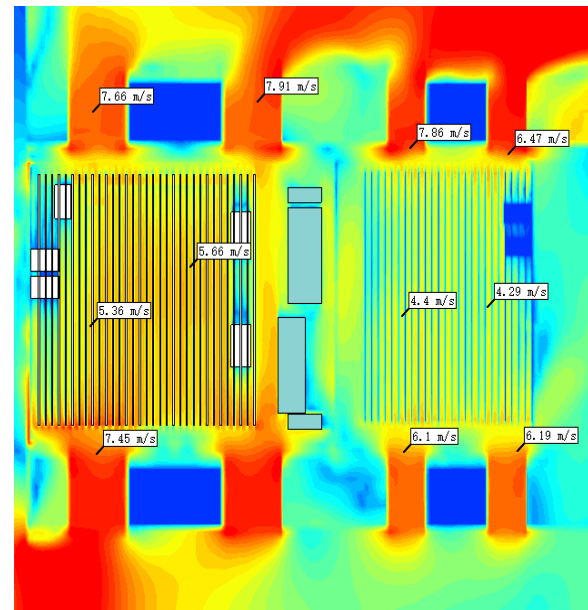
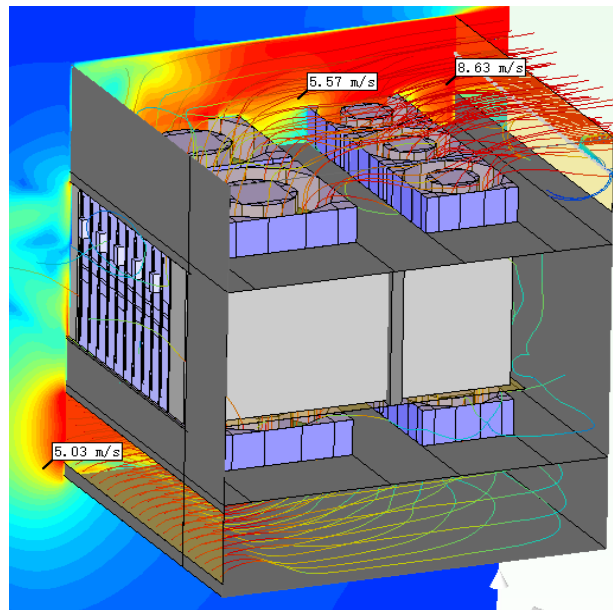
MicroTCA 整机工程---散热设计

整机工程设计

MicroTCA-散热设计(Cooling Design)

◆ System Thermal Simulation

- Two Intelligent Cooling Units is designed for The MTCA.4 Shelf , one below and one above the card cage subrack. Each Cooling Unit has 5 fans moving air from the lower side to the upper side of the Shelf in a push-pull arrangement.
- The maximum cooling capacity for AMC is 100 W and μ RTM is 40 W under ambient temperature 45°C.
- The total airflow of the MTCA.4 Shelf is 700CFM. Airflow for front slot is 30CMF(min) and 10CFM (min) for rear slot



优点(Advantages)

- 内置式双风扇框抽拉式, Z型风道
Push-Pull Cooling Mode
- 机箱拉高至10U, 提升散热能力, 每槽位>100w散热能力
The height of chassis is increased to 10U to upgrade the inlet and outlet air
- 多种风扇框配置选型 (增强、标准)
Two Fan Configuration of Standard and Reinforced Fan Tray Selection



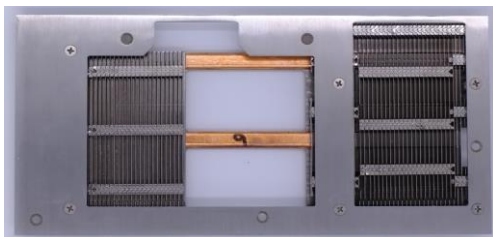
MicroTCA 整机工程---散热设计

整机工程设计

MicroTCA-Blade Heatsink

◆ Blade Thermal Solution

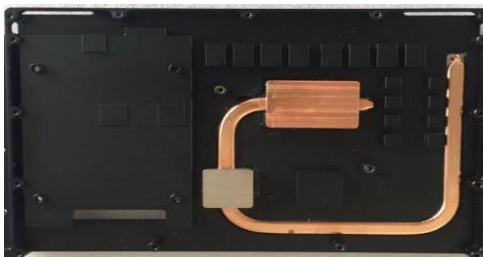
- Using heat pipe to enhances thermal transfer efficiency within heat sink
- Using thin pipe ($T < 1.5\text{mm}$) to improve thermal performance by reduce base thickness and increase fin height of heat sink for low profile heat sink
- Maximum 100W cooling capacity for a 4HP heatsink with Heat pipe
- Flexible heat sink to cover different height devices with good contact



Flexible Heatsink



Thin heat pipe heat sink



Heatpipe embedded heat sink



设计创新

- 根据AMC 功耗特带及MicoTCA机箱散热风道，量身定制AMC刀片散热器



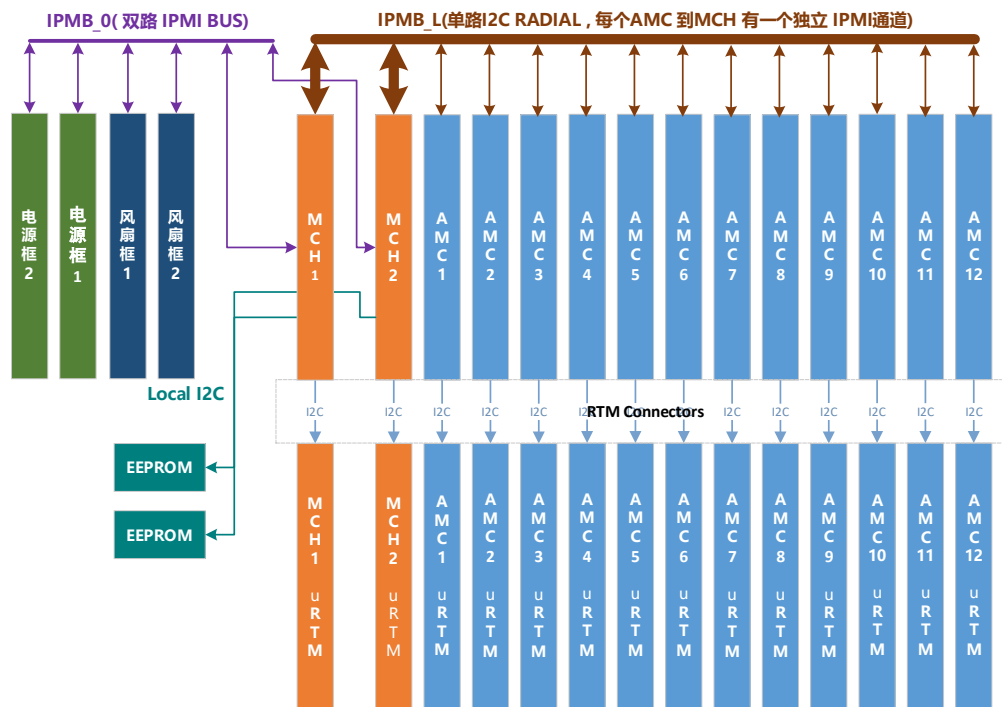
MicroTCA 整机工程---机箱管理设计

整机工程设计

MicroTCA机箱管理设计

符合标准的MicroTCA管理

- 标准MicroTCA管理IPMI协议
Standard MicroTCA Management
- 典型管理总线拓扑 (如右图所示)
Standard MicroTCA Management Bus Topology
- 可自定义管理协议, 适配定义平台管理协议设备集成商, 聚焦核心业务



设计创新

- 标准IPMI模式
Standard IPMI, YZI own code
- 自定义控制模式-聚焦核心应用, 快速部署
Customized Control Mode, focused on core application



MicroTCA 整机工程---整机设计

整机工程设计

MicroTCA-加固型整机设计 Rugged MicroTCA Chassis System

◆ 机箱结构

- 整机高度4U,前部12 AMC前卡槽位, 2个MCH槽位
4U Height,12AMC Slots, 2 MCH Slots
- 传导加固机箱
Conduction Cooling Mode
- 风道与工作区隔离设计, 抗恶劣电磁, 振动冲击, 温热能力优
The air duct is isolated from the working area, with excellent resistance to harsh electromagnetic, vibration, impact, thermal, humidity
- 带冷板, 锁紧条的AMC板卡设计。
Cold plate and tightening strip design

◆ 整机散热

- 整机600w, 前部每槽位30w散热能力
Total 600W Cooling ability, 30W Cooling ability/Slot, wave-guide window for the outside fan.

◆ 背板

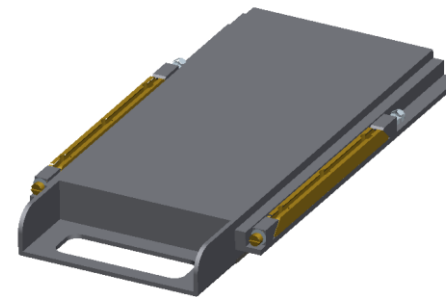
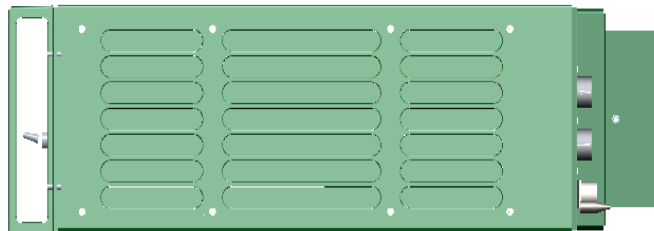
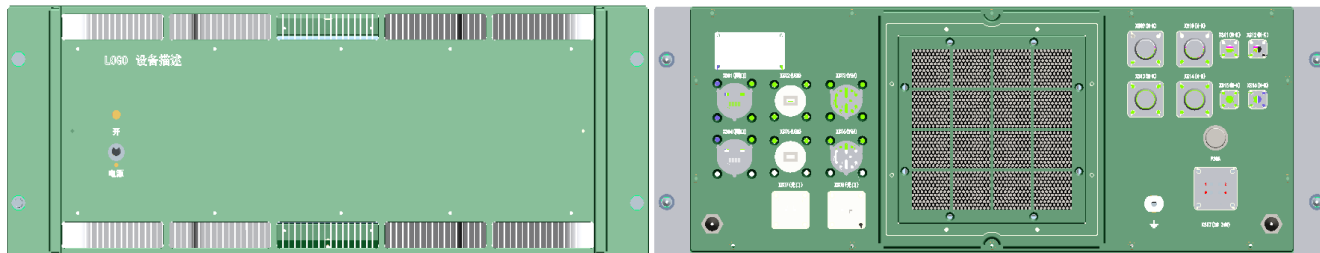
- 定制拓扑结构定制化背板, 差分速率3.125\10.3125Gbps
Customized Topology, Supporting 10.3125Gbps on Fat Pipe

◆ 加固电源

- 1个加固电源, 配航插滤波器, 可过特标
- 支持220VAC, -24VDC,电源输入,航空插座
200V AC, -24V DC
Rugged PSU, Aviation socket

◆ 机箱管理

- 支持标准IPMI机箱管理,支持应用级定制化I2C/can机箱管理
Standard IPMI and Customized I2C/CAN control msg



优点(Advantages)

- 将标准AMC板卡改造成加固导冷结构, 带冷板及锁紧条
- 工作区与散热区隔离, 工作区不受外部恶劣电磁、温热影响
- 机壳采用防锈铝, 适配特标加固机箱的恶劣工作环境
- 独特的MCH导冷技术:6HP高度, 4层PCB导冷设计能力
- 后航插走线兼容模式: 可从背板及板卡前端走线, 兼容标准板卡



MicroTCA整机工程方案

MicroTCA System Engineering Solution

MicroTCA.0整机平台



量产国产化MicroTCA.0整机平台 MicroTCA.0 Chassis System

接入网关通信平台，通过相关应用环境兼容性（电磁兼容、振动、高低温、湿热）等性能测试。

Ideal platform for the access network application



系统组成及特点(Typical Features)

- **Chassis System (self-development)**
 - 6U, 12-AMC Slot, 2 MCH Slots
 - Backplane (10.3125Gbps, Supporting Backplane Customization)
 - Cooling: Air Cooling, Pull Mode, One Intelligent Fan Tray on Rear Side
 - Power : two redundant 1200/1600/2000W PSUs
- **MCH (self-development)**
 - Third Partners ' MCH
 - YZI MCH
- **AMC Line Cards**
 - Third Partners ' AMC Line Cards

>50w/s
Cooling

1.2k1.6kW redundancy
Power

MicroTCA.0
Management

Flexibility
MCH

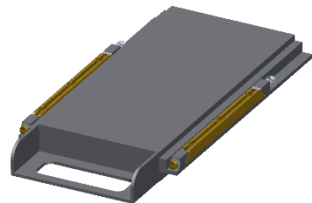
MicroTCA.0整机平台



量产国产化加固导冷MicroTCA.0整机平台 Rugged MicroTCA.0 Chassis System

恶劣环境下理想的网络通信及控制平台，通过相关应用环境兼容性（电磁兼容、振动、高低温、湿热）等性能测试。

Ideal platform for the specific application, passed environment test



系统组成及特点(Typical Features)

- **Chassis System (全部国产化)**
 - 4U, 12-AMC Slot, 12-RTM, 2 MCH Slots
 - Backplane (10.3125Gbps, Supporting Backplane Customization)
 - Cooling: Conduction cooling mode
 - Power : Special specification power PSUs
- **MCH**
 - YZI MCH
- **AMC Line Card**
 - Third Partners 'solution

>30w/s
Cooling

600W
Power

MicroTCA.0
Management

Flexibility
MCH

源中在MicroTCA标准架构系统平台上做的一些工作



量产国产化MicroTCA.4项目

实现高功率



系统组成及特点

- **Chassis System (self-development)**
 - MicroTCA.4
 - 10U, 12-AMC Slot, 12-RTM, 2 MCH Slots
 - Backplane (10.3125Gbps, Supporting Backplane Customization)
 - Cooling: Air Cooling, Push-Pull Mode, One Intelligent Fan Tray on Rear Side
 - Power : two redundant 1200/1600/2000W PSUs
- **MCH**
 - Third Partners ' MCH
 - YZI MCH
- **AMC Line Cards**
 - Third Partners ' AMC Line Cards

>100w/s	1.2k 1.6k 2kW redundancy	MicroTCA.4	Flexibility
Cooling	Power	Management	MCH



源中MicroTCA MCH方案

MCH

MCH

- ◆ 千兆交换功能: 背板支持规范规定的12个交换通道, 1个千兆更新通道及1个自定义的千兆电口背板通道, 前面板支持两个千兆电口连接到千兆交换模块

Gigabit Lan Switching

- ◆ 万兆交换功能: 背板支持规范规定的12个XAUI接口, 1个XAUI更新通道, 前面板支持两个万兆光口连接到万兆交换模块

10Gigabit Lan Switch

- ◆ 时钟功能: 时钟分配网络支持任意CLK1、CLK2、CLK3、本地时钟、SMB接入时钟作为时钟源分配到各AMC板, 通过配置, 前面板SMB时钟接口可以作输入或输出

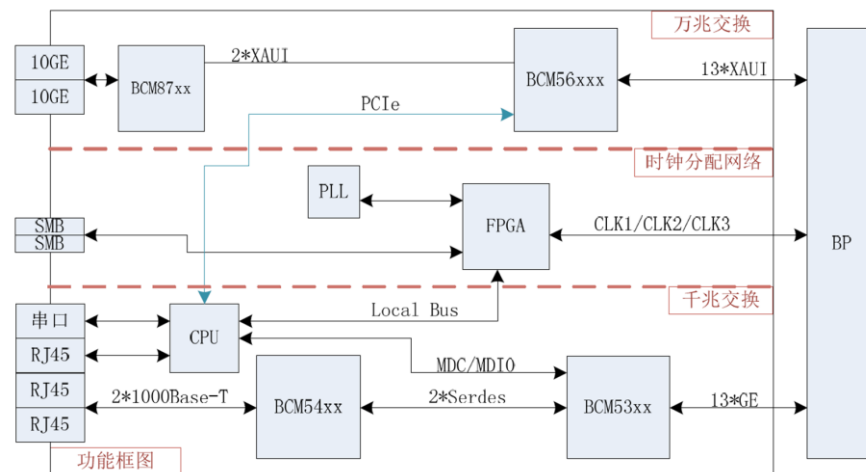
Clock Function

- ◆ PCIE交换(开发中)

PCIE3.0 Switch

- ◆ IPMI(开发中)

Simplified version of IPMI management on MCH





Succeed Beyond Chassis

谢谢
Thank You

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